

Herpetology of Habitat Types of Pakistan

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Abstract. Ecological habitats, throughout Pakistan, are defined. Characteristic vegetation is described. The association herpetofauna to each habitat fauna is given.

Key words: Ecology, vegetation, herpetofauna, Pakistan.

INTRODUCTION

Pakistan is a man's carved northwestern political division of Indo-Pakistan subcontinent and not a natural geocological entity. Its varied topography and bioclimates are reflected in the diversity of its soil, climates, habitats, flora and fauna (Khan, 1980; Roberts, 1977, 1991, 1992; Khan, 1996; Mufti *et al.*, 1997). It is surprising to note that almost most of the world's major bioclimates are represented within Pakistan and is known "the land of many lands" (Ahmed, 1951; Pfeffer, 1968; Khan, 1980; Khan, 1996). The amalgamation of physical geography with climates has played key role in the creation of multifarious habitats of the country (Mufti *et al.*, 1997). In past there have been several attempts to sketch the overall biogeophysical features of Pakistan to understand and describe its physical, floral and faunal characteristics; forest zones (Champion *et al.*, 1965), climatic regions (Ahmad, 1951), Himalayan vegetation zones (Schweinfurth, 1957), habitat zones (Beg, 1975), mammalian ecological zones (Roberts, 1977), bird distribution patterns (Roberts, 1991, 1992), fishes (Mirza, 1975), amphibians and reptiles (Khan, 1980, 1987); termites (Akhtar, 1972; Akhtar and Ahmed, 1997), butterflies (Hasan, 1997), land snails (Auffenberg, 1997).

Following fifteen habitat types have been recognized in Pakistan (Roberts, 1991; Khan, 1991). In the following section we present associated herpetofauna to these 15 habitat zones. The herpetofaunal correlations are based on herpetological reports which have so far accumulated over the years.

Herpetology of habitat types

Pakistan is a forest poor country, only 3.8% of

its total area is forested, which is continuously fast diminishing due to heavy logging and felling. Recent efforts to increase forested area by the Forest Department by afforestation and regeneration seems to be yielding results. These efforts are plantations along river banks and mostly are concentrated in the northern humid areas (Khan, 1997). Major ecological factors controlling the forest types in Pakistan are: firstly the aridity which prevails all over the Indus Plains and Balochistan Plateau, adversely affecting natural growth of flora and fauna, the richness of which is glimpsed during short summer monsoon spells; secondly, the humid northern hills and mountains which are the only conducive parts for extensive year round growth of flora and are the richest parts in fauna; thirdly, the diversity of topography and climates from plains to the mountains which rise well above snow-line and are responsible for conditions governing the altitudinal distribution of fauna and flora of the country.

Except for few chelonians and agamids none of the Pakistani herps is known to forage on vegetation, however, every vegetation zone has its characteristic resident herpetofauna. The habitat vegetation provides shelter from enemies and violent environmental changes, moreover, it supports dietary required arthropods and worms. Roots of plants and grasses make habitat soil compact for burrowing and egg laying. The leaf litter accumulating under vegetation and along forest floor, provides ideal foraging site for amphibians and reptiles. In general, vegetation composition differs from biotope to biotope so do the animals.

An ecological zone is characterized by its characteristic fauna and flora depending on prevailing ecological factors, which are diluted in the interzone areas making conditions conducive for eurytypic satellite species which form high aggregations in these areas. Fewer stenotypic species remain confined to the main habitat where conditions are at maximum. The eurytypic elements are widely distributed throughout and they form the

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bulk of the herpetofauna of an area. Natural violent disasters and the human activity disturbs the stability of the community. These two factors violently affect the sensitive stenotypic species, which either migrate in search of minimum suitable conditions or perish.

From the geocological scenario of Pakistan three major ecological regions stand out: mountains, foothills and plains. They consist of following 15 habitat types on the basis of topography, soil and natural vegetation (Roberts, 1991; Khan, 1996). Recently sufficient data has accumulated on the composition and zoogeography of the herpetofauna of Pakistan (Khan, 1980). Present paper attempts to correlate distribution of Pakistani species of amphibians and reptiles to the 15 recognized phytozones. References are cited for herp species of each zone. The distribution pattern is presented in a Table (Table I).

MOUNTAIN REGION

The mountainous rampart extends from north to the northwest of Pakistan, extending southward from western Himalayas to all along the western border with Afghanistan and Iran to the Arabian Sea coast. It covers about one third of the total area of Pakistan.

Wide ranging herpetofauna

Following species of amphibians and reptiles are widely distributed in the northern and northwestern mountains: *Bufo stomaticus*, *Euphlyctis cyanophlyctis microspinulata*, *Eublepharis macularius*, *Cyrtopodion scaber*, *Laudakia caucasica*, *Trapelus melanura*, *Calotes versicolor*, *Mesalina guttulata*, *Eremias velox*, *Ophisops jerdonii*, *Mabuya dissimilis*, *V. griseus*, *Lycodon striatus*, *Xenochrophis piscator*, *Ptyas mucosus*, *Naja oxiana*, *Echis carinatus multisquamatus*, *Pseudocerastes persicus* and *Vipera lebetina*.

While in the southwest the wide ranging species are *Bufo viridis zugmayri*, *Hemidactylus persicus*, *Paa sternosignata*, *Agrionemys horsfieldii*, *Acanthodactylus blanfordi*, *Laudakia nupta*, *L. fusca*, *Bioga malanocephala*, *C. rhodorachis*, *Eirinis persica*, *Coluber karelini* and *Spalerosophis schirazianus* are the widely distributed species (Alcock and Finn, 1896-97; Hora and Chopra, 1923; Khan, 1987; Khan and Ahmed, 1987).

Following ecobiological zones are distinguished in the Mountain Region.

1. The dry, cold alpine desert

It includes northern most regions of Pakistan, comprising parts of Chitral, Gilgit, Hunza and Baltistan. These perpetual snow deserts lie at about 4,500 to 6,000 m above sea level, while bottom valleys lie at 2,000 m. Here the climatic changes occur vertically. The mountains have permanent ice cap and glaciers rise several hundred meters above snow line. Annual rain fall varies from 50 to 100 mm, with heavy snowing during winter. Diurnal range of temperature is very pronounced, fluctuating between -6 to 25°C, throughout the year.

During short lived summer, the peripheral edges, alpine slopes, valley bottom and stream beds are bared and constitute a special cold arid habitat. They are sparsely overgrown by herbaceous xerophytic vegetation. The slopes and stream beds have several associated plant species *Hippophae rhamnoides*, willow (*Salix*), *Mertansia tibetica*, *Potentilla desertorum*; while shrubs and forbs are *Tribulus terrestris*, *Peganum harmala*, *Capparis spinosa*, *Sophora alopecuroides* and *Lycium ruthenicum*; grasses: *Festuca altaica* and *Poa attenuata*. The low plants and grasses afford protection to the agamids and snakes. Pools at the bed of ravines are breeding sites for local amphibians.

Herpetofauna

Toads *Bufo siachinensis*, *B. latastei* and *Bufo himalayanus* move about in grasses and leaf litter hiding under stones during day, while the only gekkos recorded *Tenuidactylus baturensis* lives among rocks, readily invades edifices. Mountain agamids are *Laudakia badkshana*, *L. tuberculata* and *L. himalayana*. Common grass-fields skins are *Scincella ladaensis*, while *Agkistrodon himalayanus* is collected from the bushy slopes of low hills (Wall, 1911).

2. Himalayan dry coniferous forest

This forest occurs at 1,500-3,350 m of elevation in inner and more northern ranges of the Himalayas. It is less subjected to monsoons. It gradually changes westward into moist temperate forests, however, it is generally characterized by fewer deciduous trees and single species stands of conifers. It is typified by Gilgit, Astor and Chitral in the north down to Safed

Table I.- Checklist and distribution of amphibians and reptiles of Pakistan. Numbers refer to habitat types defined in text. 1, The dry, cold alpine deserts; 2, Himalayan Dry coniferous Forest; 3, Himalayan Moist Temperate Forests; 4, Himalayan Moist Alpines Zone; 5, Balochistan hill ranges in southern latitudes, and lower slopes of some southern ranges; 6, Balochistan higher ranges; 7, Dry sub-tropical, semi-evergreen deciduous scrub forests; 8, Balochistan higher ranges; 9, Sindh Kohistan and southern Balochistan; 10, Dry Temperate semi-evergreen scrub forest; 11, sub-tropical pine forests; 12, tropical dry mixed deciduous forests; 13, Rivrine tracts; 14, Seasonal inundation zones, seepage areas Jheels and Swamps; 15, Tropical thorn forests, lower Indus plain; 16, Sand dunes in semidesert habitat: a, Thal and Cholistan Deserts, b, Thar desert, c, Sibi desert, d, Chagi-Kharan Desert; 17, Littoral and intertidal zone and off shore islands; i, Astola Island, m, main land; s, sea.

T a x a	Habitat Types														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Bufo															
<i>Bufo himalayanus</i>		+	+	+											
<i>B. melanostictus</i>			+	+			a	+	+	+					
<i>B. olivaceous</i>							b							d	
<i>B. siachinensis</i>	+														b, m
<i>B. surdus</i>							b							d	
<i>B. viridis pseudoraddei</i>		+		+			a	+		+					
<i>B. v. zugmayri</i>					+	+	b							cd	m
<i>B. lalastei</i>	+	+													
<i>B. stomaticus</i>			+	+	+	+	ab	+	+	+	+	+	+	ab	m
Microhylidae															
<i>Microhyla ornata</i>			+				a	+	+	+	+			+	
<i>Uperodon systoma</i>										+					
Ranidae															
<i>Tomopterna breviceps</i>						+	ab	+	+	+	+	+	+	a	m
<i>Euphlyctis c. cyanophlyctis</i>			+	+	+	+	ab	+	+	+		+	+	ab	
<i>E. c. microspinulata</i>					+	+	a	+							m
<i>Limnonectes limnocharis</i>			+	+			ab	+	+	+	+	+			
<i>Limnonectes syhadrensis</i>							ab			+	+	+	+		
<i>Nanorana pleskei</i>				+											
<i>Paa vicina</i>			+	+											
<i>Paa barmoachensis</i>				+		+									
<i>Paa sternosignata</i>					+	+									
<i>Paa hazarensis</i>				+				+							
<i>Hoplobatrachus tigerinus</i>						+	ab	+	+	+	+	+	+		
Emydidae															
<i>Geoclemys hamiltonii</i>											+	+	+		
<i>Hardella thurjii</i>											+	+	+		
<i>Kachuga smithi</i>											+	+	+		
<i>K. tecta</i>											+	+	+		
Testudinidae															
<i>Geoclype elegans</i>							b						+	c	m
<i>Agrionemys horsfieldii</i>					+	+								d	m

T a x a	Habitat Types															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Cheloniidae																
<i>Chelonia mydas</i>																s
<i>Eretmochelys imbricata</i>																s
<i>Lepidochelys olivacea</i>																s
Dermochelyidae																
<i>Dermochelys coriacea</i>																s
Trionychidae																
<i>Chitra indica</i>											+	+	+			
<i>Lissemys punctata</i>									ab	+	+	+	+	+		
<i>Aspideretes gangeticus</i>											+	+	+			
<i>Trionyx hurum</i>											+	+	+			
Crocodylidae																
<i>Crocodylus palustris</i>							b						+	?		?m
Gavialidae																
<i>Gavialis gangeticus</i>							b						+	?		?m
Eublepharidae																
<i>Eublepharis macularius</i>		+			+	+	ab	+		+	+			+	abc	m
Gekkonidae																
<i>A. femoralis</i>																d
<i>A. misonnei</i>																d
<i>A. persica</i>							ab									d
<i>Bunopus tuberculatus</i>		+					b							+	d	m
<i>Mesodactylus walli</i>		+														
<i>M. baturensis</i>	+															
<i>Tenuidactylus indusoani</i>							a	+								
<i>T. fortunoi</i>					+	+	a	+								
<i>T. rhodocaudus</i>																c
<i>T. rhotasfortai</i>		+					a			+						
<i>Crytopodion kohsulaimanai</i>							a									
<i>C. montiumsalsorum</i>							a									
<i>C. k. kachhensis</i>							b	+				+	+		c	
<i>C. k. inglodbyi</i>							a									
<i>C. watsoni</i>		+			+	+	a	+		+	+			+	a	
<i>C. scaber</i>		+		+	+	+	ab	+		+	+				abc	
<i>C. agamuroidae</i>																
<i>Cyrtodactylus mintoni</i>		+		+				+								
<i>C. dattanensis</i>		+	+					+								
<i>C. baturensis</i>	+															
<i>C. battalensis</i>			+	+												
<i>Hemidactylus brookii</i>			+	+	+	+	ab	+		+	+	+	+			m

T a x a	Habitat Types														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>H. flaviviridis</i>				+	+	+	ab	+		+	+	+	+		m
<i>H. frenatus</i>							b								m
<i>H. leschenaultii</i>							b								m
<i>H. persicus</i>					+	+	ab							d	m
<i>H. triedrus</i>							b								m
<i>H. turcicus</i>					+		b								m
<i>Ptyodactylus homolepis</i>							b								
<i>Crossobamon lumsdenii</i>											+	+	+	d	
<i>C. eversmanni</i>														d	
<i>C. maynardi</i>												+		cd	
<i>C. orientalis</i>							b				+	+	+	ab	m
<i>Teratolepis fasciata</i>													+	b	
<i>Teratoscincus microlepis</i>														d	
<i>T. scincus</i>														d	
<i>Tropicolotes depressus</i>														d	
<i>T. helenae</i>							b						+	c	
<i>T. persicus</i>														d	
Agamidae															
<i>Agama minor</i>							b				+				
<i>Calotes v. versicolor</i>		+		+	+	+	ab	+		+	+	+	+	abcd	
<i>C. versicolor farooqi</i>			+												
<i>Laudakia agrorensis</i>		+	+	+			a	+		+					
<i>L. badkshshana</i>	+	+	+					+							
<i>L. himalayana</i>	+	+	+												
<i>L. nupta</i>			+		+	+	a								
<i>L. fusca</i>					+										
<i>L. nuristanica</i>		+	+					+							
<i>L. tuberculata</i>		+	+	+				+							
<i>L. p. pakistanica</i>		+													
<i>L. p. auffenbergi</i>		+													
<i>L. p. khani</i>		+													
<i>L. caucasica</i>		+	+			+	a	+							
<i>L. melanura</i>		+				+	a								
<i>L. lirata</i>							ab								mi
<i>Japalura kumaonensis</i>							a	+							
<i>Trapelus agilis</i>		+					ab	+		+	+	+	+	abcd	m
<i>T. rubrigularis</i>		+					a								
<i>T. rudrata</i>					+	+									
<i>T. megalonyx</i>							b				+			b	
<i>Phrynocephalus clarkorum</i>														d	
<i>P. euptilopus</i>														d	
<i>P. luteoguttatus</i>														d	

Kon range and Takht-i-Suleiman in the south. It is distinguished further in three canopy associations:

a) *Dry temperate evergreen oak deodar forests*

Typified by lower Indus Kohistan, Swat Kohistan, northern Dir and parts of Chitral and inner valley of Hazara.

Vegetation: Canopy is formed by *Cedrus deodara*, *Pinus wallichiana*, *Gesneria ilix* and *Juglans regia*. There are scattered bushes of *Artemisia maritima*, *Ephedra intermedia*, *Corylus corlurna*, *Parrotia Jacquemontiana* and *Sophora mollis* which are used as retreat by the local reptiles.

Herpetofauna: Local amphibians consist of toads *Bufo viridis pseudoraddei*, *B. himalayanus* and *B. melanostictus* and frogs *Euphyctis cyanophlyctis*, *Tomopterna breviceps*, *Paa hazarensis*, *Limnionectes limnocharis* and *Microhyla ornata*. They are mostly found in cultivated fields. The two gekkos *Cyrtodactylus mintoni* and *Masodactylus walli* are stone gekkos, they readily invade buildings. Common garden lizard *Calotes versicolor* is found in orchards and bushes, while grass skinks *Scincella himalayana*, *S. ladacensis* and *Mabuya dissimilis* frequent grassfields. In torrent water *Xenochrophis piscator* have been collected, while *Spalerosophis diadema* and *Naja oxiana* stay around human habitations. *Vipera lebetina* and *Agkistrodon himalayanus* are found on the mountain slopes (McMahon, 1899; Anderson, 1872; Gunther, 1860; Wall, 1911).

b) *Dry zone blue pine and spruce forests*

Typical of Naltar valley and Astor in Gilgit and Takht-i-Suleiman.

Vegetation: Canopy consists of *Picea smithiana*, *Pinus wallichiana*, *Rosa webbiana*, *Ribes grossularia*, *Prunus Jacquemontii*, *Artemisia maritima*, *Ribes grossularia*, while *Berberis gambleana* and *Colutea armata* are low bushes and are used by reptiles of the habitat as a retreat.

Herpetofauna: In this zone wide ranging agamid *Japalura kumaonensis* in eastern Hazara division and at high elevations *Laudakia badkshana* and *L. himalayanus* are recorded (McMahon, 1899).

c) *Dry zone Chilgoza and Holly-oak*

Chilas, Dir, Gilgit Agency, Safed Koh, higher ranges of Malakand agency.

Vegetation: The canopy vegetation consists of *Pinus wallichiana*, *P. Gerardiana* and *Cedrus deodara*. While scattered shrubs are *Daphne leoides*, *Sophora griffithii*, *Berberis baluchistanica* and *B. lycium*.

Herpetofauna: as recorded in previous zone.

d) *Higher or inner range Himalayan dry coniferous forests*

Typified by Neelum valley, Azad Kashmir, Salkhalla and Machiara.

Vegetation: Canopy vegetation consists of *Abies pindrow*, *Picea smithiana*, *Pinus wallichiana*, and *Quercus semicarpifolia*. Along ravines and slopes different type of grasses and shrubs grow, during rainy season the area appears lush green. The ravines are covered with vegetation.

Herpetofauna: Shallow pools of water in the bed of torrents are covered with the over hanging branches of trees growing on side. Jutting-out of boulders form deep recesses where different species of frog take refuge during day. These environs provide solitude and opportunity to feed on water visiting insects even during day (Khan and Tasnim, 1989). These frogs include *Euphyctis cyanophlyctis*, *Nanorana pleskeiana* and *Paa hazarensis*. The crevices among surrounding rocks are occupied by plump-tailed gekko *Cyrtodactylus dattanensis*, *Tenuidactylus rohtasfortai* is recorded from drier rocks, both invade human habitations (Khan, 1980; Khan and Tasnim, 1990). Most common agamid in the area on low hills is *Laudakia agorensis* while other species recorded from the region are confined to higher range. Blind snakes recorded from humid soil among stones are *Typhlops porrectus*, *T. diardii platyventris*, *T. madgemintoni*, *T. m. shermani* and *T. ahsanai*. Apart from wide ranging species of snakes *Amphiesma stolata*, *Ptyas mucosus* and *Echis carinatus multisquamatus* are recorded (Khan, 1998; Khan and Khan, 1996).

3. *Himalayan moist temperate forests*

These forests extend from 3000 to 4000 m of elevation, in the inner ranges of the Himalayas. These are predominantly coniferous forests with mixed deciduous broad-leaved species. They are

typified by Murree hill ranges including Galis, lower Kaghan and Neelam valleys, extending westwards to eastern Swat, along Indus Kohistan, and is most rich in plant and animal species. This habitat is constantly under human influence, felling and over grazing are doing havoc to the herpetofauna.

Vegetation: Canopy vegetation of these forests include *Abies pindrow*, *Pinus wallaichiana*, *Taxus baccata*, *Ulmus wallichiana*, *Juglans regiaquercus* and *Prunus cornuta*, Shrub vegetation include *Berberis lycium*, *Rosa moschata*, *Skimmia laureola* and *Lonicera alpigena*. While forbs include species of genus *Impatiens* and *Euphorbia*, *Viola* and *Gentiana*. Creepers and *Hedera napalansis* and *Clematis montana*.

Herpetofauna: Wide ranging amphibian species and those recorded for previous habitats frequent waters of this habitat. In addition to the wide ranging agamids *Laudakia tuberculata* is recorded from rock outcrops. In the torrent water *Xenochrophis piscator* and *X. sanctijohannis* is found. Usual grass snakes include *Amphiesma sieboldi*, *A. stolata* and *A. platyceps*. *Vipera lebetina* and *Agkistrodon himalayanus* are found along the mountain slopes (Khan and Tasnim, 1986).

4. Himalayan moist alpine zone

It is typified by permanent grass cover and scattered junipers among tumbled boulders. The area is over grazed and modified due to intense human intervention. It is spread throughout higher slopes of the Kaghan valley, Azad Kashmir, Swat, Dir and Indus Kohistan.

Vegetation: Canopy is heterogeneous consists *Betula utilis*, *Juniperus squamata*, *Salix himalayensis*, *Saxifraga sibirica*, *Draba trinervis* and grasses belong to genus *Poa* and *Iris*.

Herpetofauna: Of the local gekko *Eublepharis macularius* abounds in crevices among gravel mixed rocks, while *Mesodactylus walli* is true stone-gecko, lives among boulders, while ground gekko *Cyrtopodion scaber* is recorded from open scrub land, where it lives in holes and crevices in earth. The plump-tail gekkos *Cyrtodactylus battalensis* and *C. mintoni* are stone crevice dwellers, often extending into human habitations (Khan, 1993). The two varanids, *Varanus flavescens* and *V. bangalensis* make their burrows in scrub lands, however, *V. bengalensis* often extends into stony slopes. The blind snake *Typhlops porrectus* is

collected from moist soil under stones. The common sand boa *Eryx johnii* and *Spalerosophis diadema* extend along human habitations. In torrent water *Xenochrophis piscator* is collected while the presence of *Natrix tessellata* has yet to be established (Wall, 1911). While grassfields and stone bushy hill slopes have *Amphiesma stolata*, *Bungarus caeruleus* and *Agkistrodon himalayanus*. *Naja oxiana* is rare (McMahon, 1901; Fenton, 1910; Murthy and Sherma, 1976, 1979; Khan, 1979; Khan and Khan, 1996; Khan and Tasnim, 1986).

5. Balochistan hill ranges in southern latitudes and lower slopes of some southern ranges

It is typified by Chaman, Mashlak reserve, Hazar Ganji, Harboi hills in Kalat and the Surkhhab valley near Peshin. Original steppic tree cover of mountain scrub forests still persists as few relict patches in wildlife reserves.

Vegetation: Original tree cover is lost due to heavy lopping for goat browse and felling. Canopy common plants are: *Juniperus macropoda*, while on higher ridges *Olea cuspidata*, *Pistacia mtica*, *Pistacia khinjuk*, *Fraxinus xanthoxyloides*, with widely scattered bushes of *Sophora mole*, *Artemisia maritima*, *Ephedra major*, *Prunus eburnea*, *Stocksia brahuica* and several bulbous perennials: *Tulipa*, *Ferula*, *Iris* and *Allium* sp., while common grasses are *Eleusine flagellifera*, *Cymbopogon parkeri* and many ephemerals of *Poa* sp. and *Bromus* sp.

Herpetofauna: In karez channels *Euphlyctis cyanophlyctis microspinulata*, *Paa stenosignata* are resident species, while *Bufo stomaticus*, *B. viridis zugmayri* and *Ophisops jerdonii* are found among marginal vegetation. *Agrionemys horsfieldii* is found in the crevices and holes cut by rain water in mud flats along karez channels and natural fountains. In the same location common ground gekkos *Cyrtopodion scaber* and *C. watsoni* are collected from crevices in the scrub land. The gekkos readily invade close - by buildings, mostly confining to the compound walls avoiding competition with resident *Hemidactylus persicus* which is common house gekko of this biotope. The lacertids *Eremias guttulata* and *Eumeces schneideri* makes their holes in flat dry fields with little low vegetation. *Acanthodactylus micropholis*, *A. canotoris* and *Eremias velox* frequent sandy soil with bushy vegetation. Local agamids *Laudakia caucascia*, *L. nupta*, *L. ruderata* frequent surrounding mountains.

The toad head agamids of genus *Phrynocephalus* are confined to sand dunes (Khan, 1987, 1999; Khan and Ahmed, 1987).

6. Balochistan higher ranges

Typified by Takatu, Zarghun, Wam-Pilghar, Ziarat and Toba Kakar ranges, closely associated with northern Malakand and southwestern Chitral. The zone consists of very arid mountains with both diurnal and seasonal extremes of temperature, winter temperature dropping to -14°C , rising in summer above 35°C . Higher slopes experience light snowfall from January to March.

Vegetation: Canopy consists of *Juniperus macropoda*, occasional *Fraxinus xanthoxyloides*, *Pistacia khinjuk* trees. There are scattered bushes of *Prunus eburna*, *Berberis baluchistanica*, *Rosa moschata*, *Salvia cabulica* and *Sophora griffithii*. Grasses include *Stipa pennata* and *Pennisetum orientalis*.

Signature herpetofauna: The Persian gekko *Hemidactylus persicus* is common edifice lizard, *Eublepharis macularious* lives in gravel and stony sides of the mud flats. The scrub land gekkos are *H. scaber* and *watsoni*. While *Laudakia caucasica*, *L. nupta* are found on cliffs. *Agrionemys horsfieldii*, ground agamids *T. ruderata* and *Uromastix asmusi* frequent mud flats and scrub land, where *Varanus griseus* abounds. *Calotes versicolor* and *Boiga melanocephala* are arboreal shrub dwellers. *Acanthodactylus blanfordi*, *Eremias velox* are common sand lizards. *Pseudocerastes persicus* and *Vipera labetina* are collected from bushy slopes of mountains. While in wetlands common amphibians are *Bufo stomaticus*, *B. v. zugmayri*, *Euphlyctis c. microspinulata* and *Paa sternosingata*, *Ramphotyphlops braminus*, *Leptotyphlops blanfordii* are recorded (Alcock and Fin, 1896-97; Hora and Chopra, 1923; Khan, 1987; Khan and Ahmed, 1987).

FOOT HILLS

The foothills extend as an arid strip along southern face of the sub-Himalayas and western Balochistan hilly tracts. It comprises of ridges of sandstone and limestone escarpments. In the north it is interspersed with less soil deposits, is heavily overgrazed and heavily eroded into deep gullies. The foothills are distinguished in several ecobiological habitats, where plain and mountain species are mixed. In the north it is typified by the Salt Range,

Kala Chitta hills, and in the northwest by the Waziristan hills and Dera Ismael Khan, while in the south are Dera Ghazi Khan, Rajanpur and the Pat-the area between Kirthar ridge and the Indus River.

Wide ranging herpetofauna

In the foot hills wide ranging wetland species are *Bufo stomaticus*, *B. v. zugmayri*, *Microhyala ornata*, *Euphlyctis cyanophlyctis microspinulata*, *Holobatrachus tigerinus*, *Tomopterna breviceps*, *Limnoectes limnocharis*, *Lissemys punctata*, *Amphiesma stolata*, *Xenochrophis piscator*, species of stony gravel include *Eublepharis macularius*, *Hemidactylus brooki*, *Trapelus agilis*, *T. melanura*, *Coluber rhodorachis*. Sandfield lizards are *Acanthodactylus cantor*, *Mesalina guttulata*, *Eremias velox*, snakes *Eryx johnii*, *Spalerosophis arenarius*, *Psammophis leithii* and *P. schokari*, while grassland lizards are *Ophisops jerdonii*, *Ablepharus pannonicus*, *E. taeniolatus*, *Scincella himalayana* and *Mabuya dissimilis*. Common scrub land species are *Cyrotopodion scaber*, *C. watsoni*, *C. montiumsalsorum*, *Varanus bengalensis*, *V. griseus*, *Coluber ventromaculatus*, *Lycodon striatus*, *Oligodon arnensis*, *O. taeniolatus*, *Bungarus caeruleus*, *B. sindanus razai*, *Naja naja* and *Naja oxiana*. *Arboreal species are Calotes versicolor* and *Boiga trigonata*. While in tilled areas are *Ramphotyphlops braminus*, *Typhlops porrectus*, *Ptyas mucosus*, *Spalerosophis diadema* and *Vipera russelii* (Stoliczka, 1872; Minton, 1962, 1966; Mertens, 1969, 1970, 1971, 1974; Khan, 1979, 1980, 1986, 1988, 1997; Khan and Baig, 1988).

The foot hills are distinguished in following habitat types:

7. *Dry sub-tropical, semi-evergreen deciduous scrub forests* are distinguished in two sub-zones:

a) Tropical dry deciduous forests

This habitat is characterized by the sub-humid climatic conditions, in the sub-mountain Siwalik strip with recent alluvial deposits and is restricted to narrow Jhelum Valley and outer Margala Hills, Salt Range, Kala Chitta Hill and eastern Waziristan. Annual rain fall varies 500-1000 mm.

It is the most varied habitat, with moderate vegetation and humid climatic conditions.

Vegetation: Dominant vegetation is comprised of scattered *Acacia jacquemontii*, *A. senegal*, *Commiphora mukul*, *Ziziphus nummularia* trees;

while widely distributed bushes are *Rhazya stricta*, *Euphorbia caducifolia*, *Gewia tenax* and *Bepharis sindica*.

Signature herpetofauna: Along with common species of amphibians listed above southeast Asian toad *B. melanostictus* frequents the leaf litter. The greater sandstone gekko *Tenuidactylus rohtasfortai* frequents crevices among sandstone rock, scrub land ground gekkos are *Cryptopodion montiumsalsorum*, *C. watsoni* and *C. scaber*, while in western mountains extends *C. kachhensis ingoldbyi*. House gekko is *Hemidactylus flaviviridis*, while barn gekko *H. brooki* frequents open spaces with vegetation. The Persian house gekko *H. persicus* is collected from Rohtas Fort and Waziristan Hills in the west. The moist grass fields along water channels are frequented by *Mabuya dissimilis*, *Eumeces taeniolatus* and *E. schneideri*, *Acanthodactylus cantoris*, *Amphiesma stolata* and *Daboia russellii*; while *Eremias fasciata* is collected from sand fields in Dera Ismael Khan in the west. In the western stony hilly areas *Eirenis persica* and *Echis carinatus multisquamatus* have been recorded (Stoliczka, 1872; Khan, 1979, 1988, 1997; Khan and Baig, 1988).

b) Sindh Kohistan and southern Balochistan

Moderate temperature, low rainfall desert, with pronounced humid monsoons during summer; dry, frost free, mild winters, dominated by a steady inflow of sea-breeze throughout summer. High humidity, low annual and diurnal temperatures; annual rainfall 170-200 mm. Typified by Karachi, Malir, Sindh Kohistan, Las Bela, Makran range, Lakkhi and Pabb hills, Kirthar range.

Vegetation: Clumps of cactus of genus *Euphorbia* dominate the landscape around Makran Range, Lakkhi and Pab Hills, Kirthar Range. While *Acacia jacquemontii*, *A. senegal*, *Commiphora mukul* and *Ziziphus nummularia* form scattered stunted tree vegetation. Bushes are *Rhazya stricta*, *Euphorbia caducifolia*, *Grewia tenax* and *Blepharis sindica*.

Herpetofauna: One of the herpetologically most rich and better known region in Pakistan.

In addition to the wide ranging species, listed above, several south Indian species have been recorded from this zone; *Hemidactylus frenatus*, *H. leschenaulti*, *H. persicus*, *H. turcicus*, *Geochelone elegans*, *Chameleon zeylanicus*, *Crocodylus palustris*, *Python molurus* and *Eryx conicus*. While endemic species are: *Bufo olivaceus*, *B. surdus*, *Ptyodactylus*

homolepis, *Cyrtopodion kachhensis*, *Tropicolotes helenae*, *Acanthodactylus micropholis*, *Ophiomorus blanfordi*, *Uromastix asmussi*, *Leptotyphlops macrorhynchus*, *L. blanfordi*, *Spalerosophis arenarius*, *Psammophis schokari*, *P. leithii* and *P. condanarus* and *Pseudocerastes persicus* (Shockley, 1949; Monton, 1962, 1966; Mertens, 1962, 1969).

8. Dry temperate semi-evergreen scrub forest

Characterized by long cold winters with some seasonal winter rain. The forest covers wide latitudinal geographical range, typified by southern Chitral, Dir, Malakand agency, Indus Kohistan, Amb, Bunir and eastern fringes of northern Waziristan, Khyber, Mohmand agency, Bannu and Kohat. The summer is hot, dry, limited monsoon influence, some spring and winter rains.

Vegetation: The vegetation is very low and varied, consists of *Olea cuspidata*, *Acacia modesta*, *Artemisia maritima*, *Monothea buxifolia*, *Adhatoda vasica*, *Dodonaea viscosa*, *Mallotus philippinensis*, *Lannea coromandelica*, *Mohthea bxifolia*, *Rhazya stricta*, and *Wirhania coagulans*. With occasional trees of *Celtis eriocarpa* and in ravines *Nannorrhops ritchieana*, dwarf palm, grasses include *Eleusine compressa*, *Chrysopogon aucheri*, *Cymbopogon jawrancusa* and *Saccharum spontaneum*.

Signature Herpetofauna: The stone-gekkos include *Mesodactylus walli*, *Cyrtodactylus mintonai*, *C. battalensis*; while scrub lands have *Cyrtopodion scaber*, *Varanus flavescens*.

The grass fields have *Scincella ladacensis*, *Mabuya dissimilis*, *Lygosoma punctata*, *Typhlops porrectus*, *Lycodon bicolor*, *Naja oxiana*, *Spalerosophis diadema*, *Ptyas mucosus* and *Bungarus caeruleus*. The mountain escarpments have *Eirenis persica*, *Pseudocerastes persicus* and *P. bicornis* (McMahon, 1901; Ingoldby, 1922).

9) Sub-tropical pine forests

Unique tall tree forests occurring at 910-1,820 m of elevation. Typified by Kahuta, parts of Mangla dam, lower Kaghan valley around Kuwai, Bbatrasi pass, lower Swat and lower Murree hills around Tret. Subjected to periodic fires.

Vegetation: Canopy is formed of *Pinus roxburghii*, *Quercus incana*, *Ficus palmata*, *F. roxburghii* and *Punica granatum*. While understory vegetation is: *Ziziphus oxyphylla*, *Carissa opaca*, *Woodfordia fruticosa*, *Spiraea canescens*, *Buddleia paniclata*, *Beberis lycium* and *Indigofera pulchella*.

Grasses are: *Heteropogon contortus*, *Aristida cyanantha*, *Apluda aristata* and *Themeda anathera*.

Signature Herpetofauna: Amphibians include *Bufo viridis pseudoraddei* and rare *Uperodon systoma*. In addition to wide ranging agamids *Japalura kumaonensis* is collected from mountains. *Python molurus* is washed down in Punjab by flood waters in River Jhelum and Chenab. In scrub lands and grass fields are *Oligodon arnensis*, *Lycodon striatus*, *Sibynophis sagittarius*, *Bungarus caeruleus razai*, *Naja naja*, *Echis carinatus sochureki* and *Daboia russelii* (Khan and Tasnim, 1989, 1990; Khan and Baig, 1988).

10. Tropical dry mixed deciduous forests

It is disjunct habitat, confined on more sheltered ravines and northern facing slopes and is an extension of the Siwalik zone to further east. Typified by Karot valley which drains in Jhelum River, Kahuta, lower Lehtrar valley and ravine sides in the Margalla hills.

Vegetation: Forty species of plants have been recorded from this habitat, of which widely scattered are: *Acacia modesta*, *Bauthinia variegata*, *Cassia fistula*, *Celtis eriocarpa*, *Mallotus philippinensis*, *Pyrus pashia*, *Salmalia malabaricum* and *Sterculia villosa* with understory of *Zizyphus mauritiana*, *Porana paniculata* and *Woofordia floribunda*. Grasses: *Heteropogon controtus*, *Aristida cyanantha*, *Apluda aristata* and *Themeda anthera*.

Herpetofauna: as recorded for previous two zones (Khan and Tasnim, 1989, 1990; Khan and Baig, 1988).

INDUS PLAINS

The Indus plains are characteristic flat, leveled, stretch of land from the sub-Himalayas in the north to the Arabian Sea coast in the south. It consist of deep stone free layer of alluvial silt which has been washed down from the Himalayas through centuries. The plains have a gradual sink from sub-Hiamalayas to the sea level: Rawalpindi is situated at 500 m of elevation, Multan at 200 m, Sukkhur 100 m and Hyderabad at 30 m. The climate type is sub-tropical continental lowland, with high summer temperature and late monsoon rains. Characteristic feature is aridity and continentality. Annual rainfall ranges 350-400 mm, mostly coming in July to August, temperature range from 5-48°C.

Wide ranging herpetofauna

In the plains wide ranging herp species are: *Bufo stomaticus*, *Microhyla ornata*, *Euphlyctis c. cyanophlyctis*, *Holobatrachus tigrinum*, *Tomopterna breviceps* (spotty), *Limnonectes limnocharis*, *Lissemys punctata*, *Eublepharis macularius*, *Hemidactylus brooki*, *H. flaviviridis*, *Trapelus agilis*, *T. melanura*, *Acanthodactylus cantoris*, *Mesalina guttulata*, *Ophisops jerdonii*, *Ablepharus pannonicus*, *E. taeniolatus*, *Mabuya dissimilis*, *Varanus bengalensis*, *V. griseus*, *Ramphotyphlops braminus*, *Typhlops porrectus*, *Eryx johnii*, *Boiga trigonata*, *Coluber rhodorachis*, *C. ventromaculatus*, *Lycodon striatus*, *Amphiesma stolata*, *Xenochrophis piscator*, *Oligodon arnensis*, *O. taeniolatus*, *Psammophis leithii*, *P. schokari*, *Lytorhynchus paradoxus*, *Ptyas mucosus*, *Spalerosophis diadema*, *Bungarus caeruleus*, *Naja naja*, *Naja oxiana*, *Daboia russelii* (Minton, 1966; Mertens, 1969; Khan, 1980).

The Indus plain is distinguished into Punjab Plain and the Indus Delta, in which following five life zones are recognized:

11. Riverian tracts

The Punjab plain is traversed by five major tributaries of Indus River, which subdivided it into four interfluve-the *Duabs* which are belts of fertile alluvium between the rivers, have extensively been modified by reclamation and ramification of complex canal system. The plain receives scanty annual rainfall of 300 mm, most of which comes during summer monsoons. The silted rivers soon inundate widely the interfluves. Summer temperature exceed 42°C while winter 8-10°C.

Vegetation: Climax vegetation consists of *Acacia arabica*, at drier areas hold *Tamarix dioica* and *Populus euphratica* with grasses *Erianthus munja*, *Saccharum munja* and *S. spontaneum*.

Herpetofauna: The regular annual flooding of the area disturbs animal and plant life extensively, so that herp species are common to all interfluves, no endemic species has been recorded from this zone. All freshwater and mud turtles, so far reported from Pakistan, are represented. Apart from wide ranging amphibian species recorded for the previous zones south Indian frog *Limnonectes syhadrensis* prevails here. River turtles *Hardella thurjii*, *Kachuga smithii*, *K. tecta*, *Chitra indica*, *Lissemys punctata*, *Aspideretes gangeticus* and *A. hurum* frequent waters throughout Indus riparian system.

While plain agamids are *Trapelus agilis*, *T. megalonyx*, *T. rubrigularis* and arboreal agama *Calotes versicolor* abounds. Rare *Agama minor* is reported for the first time from Rabwah, Pakistan (Mertens, 1974; Khan and Mirza, 1977). The pssamophilous lizards include wide ranging species *Acanthodactylus cantoris*, *Mesalina guttulata*, *Ophiomorus tridactylus*. Common grass skinks are *Ophisops jerdonii*, *Ablepharus panonicus*, *Eumeces taeniolatus*, *E. indothalensis*, *Mabuya dissimilis* and *M. macularia*. Three species of varanids occur in the plains *Varanus bengalensis*, *V. flavescens*, *V. griseus koniecznyi*. Snakes in addition to recorded for previous zones are *Eryx conicus*, *Python molurus*, *Coluber ventromaculatus*, *Spalerosophis arenarius*, *Lytorhynchus paradoxus*, *Lycodon bicolor*, *L. travancoricus*, *Natrix sanctijohannis*, *Xenochrophis cerasogaster*, *Naja naja*, *N. oxiana*, *Psammophis schokari*, *P. leithii*, *Bungarus caeruleus sindanus*, *Naja naja*, *Echis carinatus pyramidum* (Loveridge, 1959; Mertens, 1969; Minton, 1966; Khan, 1984a,b, 1986).

12. Seasonal inundation zones, seepage areas Jheels and swamps

This zone is subjected to almost regular summer flooding, becoming dry by April-May. It is typified by disjunct inter-riverain strips around Trimmu and Balloki Headworks and Lal Suhanra near Bahawalpur in Punjab. Swampy areas around east Nara and Sanghar, Ghauspur in Jacobabad District, Manchar in Dadu District in Sindh. It includes major lakes lying in the Indus delta and lower Sindh.

Vegetation: Scattered trees are *Tamarix dioica*, *Phragmites karka*, *Typha angustata*, *Paspalum distichum*, *Imperata cylindrica*, and *Nelumbium nuciferum*. In pooled water *Vallisneria spiralis* and *Hydrilla verticillata* for the most of the emergent vegetation.

Herpetofauna: In addition to the wide ranging amphibian and reptilian species recorded for the previous zones, in this zone there is preponderance of river turtles: *Geoclemys hamiltonii*, *Hardella thurjii*, *Kachuga smithii*, *K. tecta*, *Chitra indica*, *Lissemys punctata*, *Aspideretes gangeticus*, *A. hurum*. While blind snakes *Typhlops porrectus*, *Leptotyphlops blanfordi*, *L. macrorhynchus* frequent the moist soil along water channels. Sandy scrub land is frequented by *Eryx conicus*, *Python molurus*, *Argyrogena fasciolatus* and *Echis carinatus*

pyramidum. In the lakes *Xenochrophis cerasogaster* and *Enhydryis pakistanica* are the signature species (Minton, 1962, 1966; Mertens, 1969; Khan, 1980).

13. Tropical thorn forests

This habitat, before human intervention, occupied the whole of the Indus plain, from the foothills to the sea coast. Human activity over more than thousand years has almost eliminated this habitat. Tropical thorn vegetation survives in small pockets where human interferences is restricted, around airfields, graveyards and uncultivated lands such as saline flats or 'pats'.

Vegetation: In Punjab these thorn forests are composed of scattered shrubby trees of *Prosopis spicigera*, *Capparis aphylla*, *Salvadora oleoides*, *Tamarix aphylla* and *Ziziphus mauritiana*. While in lower Sindh consists of *Euphorbia caducifolia*, *Calatropis procera* and *Suaeda fruticosa* with grasses *Aristida depressa* and *Eleusine compressa*.

Herpetofauna: As recorded for previous region (Minton, 1962, 1966; Mertens, 1969; Khan, 1980).

14. Sand-dune deserts

There are five sand-dune deserts scattered throughout the country: in the northwwest Punjab Thal, Cholistan in southeast; Thar desert in the eastern Sindh; in the northeastern Balochistan Sibi, and in the southwest is *Chagai-Kharan* desert. Deserts occupy about three fourth of the plains of Pakistan (IUCN fact sheets). Thus aridity is the overall hall mark of Pakistan. The fauna and flora of deserts is largely drawn from neighboring desert fauna and flora.

Common desert: Plants shared among Pakistani deserts are: *Prosopis spicigera*, *Ziziphus mauritiana*, *Salvadora oleoides*, *Calligonum polygonoides*, *Calotropis procera*, *Aristida mutabilis*, *Saccharum bengalensis*. The first three plants grow to fair sized trees. *Calligonum* particularly grows and colonize sand-dunes.

Herpetofauna: Desert habitat is made suitable for most of the wide ranging plain amphibians by recent reclamation of peripheral parts of the deserts (Khan, 1985; Khan and Ahmed, 1987). *Bufo olivaceus* and *B. surdus* are particularly known from oasis in the Balochistan deserts. There are several exclusively desert reptilian genera: *Agamura*, *Bunopus*, *Crossobamon*, *Teratolepis*, *Teratoscincus*, *Tropicolotes*, *Phrynocephalus*, *Eremias*, *Acanthodactylus*, *Ophiomorus*, *Lytorhynchus*, *Psammophis* and *Eristicophis*.

a) *The Thal desert*

It lies between Jhelum-Chenab and Indus rivers in the northwestern Punjab. Occasional scanty rainfall, treeless loose sandy soil and precarious and scattered pasturage are its characteristics. The desert lies 100-155m above sea level. Dust storms and hot wind or *Lu* are the important summer features. Its peripheral parts are largely reclaimed.

Vegetation: Scattered *Prosopis spicigera*, *Ziziphus mauritiana* and *Salvadora oleoides* grow to fair sized trees. While *Calligonum polygonoides*, *Calotropis procera* remain prostrated or bushy in formation. The grasses are *Aristida mutabilis* and *Saccharum bengalensis* of which *Calligonum* is particularly adapted to grow and colonize sand dunes.

Herpetofauna: Almost all the plain's amphibians are represented in the well watered parts of the desert. Agamids belonging to genus *Trapelus*, *Agama minor*, *Crossobamon orientalis*, *Acanthodactylus cantor*, *Eumeces schneiderii*, *Ophiomorus tridactylus*, *Varanus griseus*, *Lytorhynchus paradoxus*, *Psammophis leithii*, *P. schokari*, *Spalerosophis arenarius*, *Bungarus sindanarus razai*, *Naja oxiana*, *Echis carinatus multisquamatus*. An endemic species *Eumeces indothermalensis* has recently been described from this desert (Khan and Khan, 1997).

b) *The Cholistan desert*

The arid sand dune strip lying on the east of Sutlej River in the southeastern Punjab, continuing with Rajasthan desert of India, is known as Cholistan. It continues with Thar desert of Sindh. Annual rain fall remains between 50-100 mm, some years are without rain. Its part lying along River Sutlej is reclaimed, and extensively canalized.

Vegetation: Scattered stunted trees are *Tamarix aphylla*, *Prosopis spicigera*, *Capparis decidua*, *Calligonum polygonoides*, *Leptadenia spartium*, *Haloxylon griffithii*, while common grasses are *Aristida depressa*, *Saccharum spontaneum*, *Cymbopogon shoenantus* and *Pennisetum* spp.

Herpetofauna: Almost all plain's amphibian species are represented in the reclaimed parts of the desert. Similarly wide ranging reptilian species are represented. No endemic form is recorded, however, Himalayan forms *Xenochrophis sanctijohannis* and *Tomopterna breviceps* are recorded from the waters (Khan, 1984a,b, 1985).

c) *The Thar desert*

It is the western extension of the great Indian desert Rajasthan into southeastern Sindh. It consists of largely, sand-hills which vary from small dunes to 30-50 m high sand-hills, overlying the Indus alluvium. At places are scattered sandstone rocks and ridges, separated by valley of varying breadths. High annual and diurnal temperatures, dust storms in summer are its usual features. Wherever water is available, thick forests occur.

Vegetation: In addition to common desert plants scattered stunted bushes of *Tamarix aphylla*, *Euphorbia caducifolia*, *Commiphora mukul*, *Ziziphus nummularia*, *Grewia tenax*, *Cassia angustifolia*, *Calligonum polygonoides* and *Blepharis indica*.

Herpetofauna: All wide ranging plain's amphibian and reptilian species are represented. Endemic species recorded are *Cyrtopodion kachhensis*, *Hemidactylus leschenaulti*, *Teratolepis fasciata*, *Tropicolotes helenae*, *Mesalina brevirostris*, *Eumeces schneiderii*, *Ophiomorus raithmal*, *O. tridactylus*, *Eryx conicus*, *Python molurus*, *Lytorhynchus travancoricus*, *Psammophis condanarus*, *P. leithii*, *P. schokari*, *Bungarus sindanarus* and *Echis carinatus pyramidum* (Minton, 1962, 1966; Mertens, 1969).

d) *The Sibi desert*

It lies between Sulaiman and Kirthar ranges on the west bank of Indus and is the hottest part of Pakistan, since it is sandwiched between two arid mountain ranges. The soil is hard, stony and gullied.

Vegetation: In addition to the wide ranging desert species *Capparis decidua*, *Suaeda fruticosa*, *Tamarix troupii* and grass *Panicum antidotale* are recorded.

Herpetofauna: All wide ranging amphibian species except *Holobatrachus tigerinus*, *Tomopterna breviceps*, *Limnonectes limnocharis* and *L. syhadrensis* are represented. Endemic forms recorded are *Ptyodactylus homolepis*, *Cyrtopodion kohsulaimanai* and *Cyrtopodion kachhensis ingoldbyi* (Khan, 1991, 1993, 1997).

e) *The Chagai-Kharan desert*

It lies in the southwestern Balochistan, at 610-1060 m of elevation, and is the hottest and driest deserts of Pakistan. It is subjected to dust-storms which constantly blow sand-dunes here and there, throughout the year. Annual rainfall, is highly

uncertain, 0-60 mm. Vast fields of sand dunes interspersed with hard alluvial soil support stunted grasses and bushes. At place soil sinks in depressions which are filled by rain water and form salt lakes-Humans. The lakes are fringed with thick vegetation, in draught the salt encrusted clay at lake basin is sun-cracked, with few persisting marshy patches. The fringing reed and tamarick patches provide shelter to local herps.

Vegetation: *Haloxylon ammodendron*, *Rhazya stricta*, *Astragalus sericostachys*, *Peganum harmala*, *Salsola arbuscula*, grasses *Eleusine compressa*, *Pennisetum dichotomum*, *Andropogon halapensis* and *Nepeta glomerulosa*.

Herpetofauna: Herpetologically riches part of Pakistan, with large number of endemics *Bufo olivaceous*, *B. surdus*, *B. viridis zugamyri*, *Euphyctis cyanophlyctis microspinulata*, *Agamura femoralis*, *A. persica*, *Bunopus tuberculatus*, *Crossobamon lumsdenii*, *C. maynardi*, *Teratoscincus Crossobamon lumsdenii*, *C. maynardi*, *Teratoscincus microlepis*, *T. scincus*, *Tropicolotes depressus*, *T. helenae*, *T. persicus*, *Phrynocephalus clarkorum*, *P. euptilopus*, *P. luteoguttaus*, *P. maculatus*, *P. ornatus*, *Uromastyx asmussi*, *Acanthodactylus blanfordi*, *A. micropholis*, *Eremias acutirostris*, *E. aporosceles*, *E. fasciata*, *E. scripta*, *E. velox*, *Ophiomorus breviceps*, *O. tridactylus*, *Eryx tataricus*, *Boiga melanocephala*, *Coluber karelini*, *Lytorhynchus maynardi*, *L. ridgewayi*, *Pssamophis lineolatus*, *P. schokari*, *Spalerosophis schirazianus* and *Eristicophis macmahonii* (Minton, 1962, 1966; Mertens, 1969; Khan, 1987; Khan and Ahmed, 1987).

15. *The Littoral and inter-tidal zone, off shore islands*

Typified by Mouth of Indus, Somiani and other bays along the Makran coast characterized by mangroves, Astola Island.

Vegetation: Scattered bushes and stunted trees of *Avicennia officinalis*, *Ceriops tagal*, *C. candolleana*, *Halopyrum mucronatum*, *Bruguiera conjugata* and scrubs *Salsola fietida* and *Sueda fruticosa*, grasses: *Heleochoa dura* and *Halopyrum mucronatum*.

Herpetofauna: In this coastal biome marine turtles and sea snakes are represented. The marine turtle species who regularly visit coastal beaches of Pakistan to lay eggs are *Chelonia mydas*, *Lepidochelys olivacea* and *Dermochelys coriacea*

(Minton, 1962, 1966; Mertens, 1969).

Several freshwater turtles from the Indus river system are known to extend in the coastal mangroves.

The marine snakes recorded are *Hydrophis cyanocinctus*, *H. spiralis*, *H. lapemoides*, *H. caeruleus*, *H. mamillaris*, *Enhydrina schistosa*, *Praescutata* and *Lepemis curtus*.

Occasional reports indicate occurrence of some isolated individuals of *Gavialis gangeticus* along the Makran coastal swamps. However, a disjunct population of *Crocodylus palustris* has been reported from Hab River (Minton, 1966).

The herpetofauna of offshore islands consists of disjunct populations of reptiles, which have morphological varied from the main land forms due to long isolation.

Following species have been recorded from Astola Island, 25 km SE off the Pasni coast, Balochistan (Mertens, 1969): *Acanthodactylus cantoris*, *Masalina guttulata*, *Eumeces schneideri zarudnyi*, *Laudakia lirata*, *Trapelus agilis*, *Coluber rhodorachis*, *Spalerosophis diadema* and a new species *Ecis carinatus astole*.

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